

1 **CLAIMS**

2 1. In a distributed computing environment, a method comprising:
3 receiving data from a data store, the data corresponding to a plurality of
4 objects; and

5 responsive to receiving the data, dynamically generating multiple
6 hierarchies of inter-object relationships based on values of attributes of the objects,
7 the multiple hierarchies of inter-object relationships being a data polyarchy.

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9 2. A method as recited in claim 1, wherein the data store comprises a
10 directory or a database.

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12 3. A method as recited in claim 1, wherein the data polyarchy comprises
13 intersecting hierarchies of inter-object relationships.

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15 4. A method as recited in claim 1, wherein the data polyarchy comprises
16 an elastic inter-object relationship.

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18 5. A method as recited in claim 1, wherein dynamically generating
19 multiple hierarchies of inter-object relationships further comprises:

20 identifying a dimensional relationship of one or more dimensional
21 relationships between a first and second object of the objects; and

22 inserting the first object into the second object such that the first object is
23 represented in the second object with respect to the dimensional relationship.
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3 6. A method as recited in claim 1, wherein first and second objects of
4 the objects are respectively represented in the data polyarchy as separate entities,
5 and wherein dynamically generating multiple hierarchies of inter-object
6 relationships further comprises:

7 identifying a dimensional relationship of one or more dimensional
8 relationships between the first object and the second object; and

9 inserting a link to the first object in the second object with respect to the
10 dimensional relationship.

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12 7. A method as recited in claim 6, wherein the link is a jump gate.

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14 8. A method as recited in claim 1, wherein the multiple hierarchies of
15 inter-object relationships are represented independent of object naming and
16 independent of a predetermined hierarchical data structure.

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18 9. A method as recited in claim 1, wherein the inter-object relationships
19 represent mono-directional object relationships and bi-directional object
20 relationships.

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22 10. A method as recited in claim 1, wherein is the data polyarchy
23 comprises a membership hierarchy that provides for de-referenced dimensional
24 navigation of a many-to-many object relationship.

1 **11.** A method as recited in claim 1, wherein generating the data
2 polyarchy further comprises:

3 relating a first and a second object of the objects to a third object of the
4 objects to facilitate de-referenced dimensional navigation of a many-to-many
5 object relationship between the first, second, and third objects.
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7 **12.** A method as recited in claim 1, further comprising naming an inter-
8 object relationship in the data polyarchy with a natural language.
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10 **13.** A method as recited in claim 1, wherein generating the data
11 polyarchy further comprises establishing, for individual ones of the objects, a
12 plurality of predicates to indicate how to access the individual ones of the objects.
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14 **14.** A method as recited in claim 1, wherein generating the data
15 polyarchy further comprises establishing for individual ones of the objects a
16 plurality of domain properties to index the individual ones of the objects.
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18 **15.** A method as recited in claim 14, wherein the domain properties
19 comprise a data type, a data precision indication, a scale indication, and a
20 nullability indication.
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1 16. A method as recited in claim 1, wherein generating the data
2 polyarchy further comprises determining the relative distribution of attributes of
3 the objects to establish a strategy to present or search for objects that comprise the
4 attributes.

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6 17. A method as recited in claim 1, wherein generating the data
7 polyarchy further comprises:

8 determining the relative distribution of attributes of the objects to establish
9 a strategy to present or search for objects that comprise the attributes, and wherein
10 the strategy comprises one or more of the following operations:

11 a first operation to find a default search object of the objects;

12 a second operation to locate a particular object of the objects;

13 a third operation to obtain a default hierarchy of data relationships that
14 correspond to a particular object of the objects;

15 a fourth operation to obtain a particular hierarchy of data relationships that
16 correspond to a particular object of the objects;

17 a fifth operation to identify at least one subset of a plurality of hierarchies
18 of data relationships that correspond to a particular object of the objects; and

19 a sixth operation to obtain multiple hierarchies of data relationships that
20 correspond to a particular object of the objects.

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22 18. A method as recited in claim 17, wherein the strategy comprises a
23 recursive access strategy or a linear scan access strategy.
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1 **19.** A method as recited in claim 17, wherein the domain properties
2 comprise a logical domain property comprising a distinguishing domain, a
3 locating domain, or a classifying domain.

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5 **20.** A method as recited in claim 1, wherein each object further
6 comprises one or more respective attributes, and wherein generating the data
7 polyarchy further comprises:

8 identifying a plurality of distinguishing attributes, each distinguishing
9 attribute representing a respective object of the objects that is a root of a hierarchy,
10 each distinguishing attribute being from a substantially unique distribution of
11 similar attributes across the objects;

12 identifying one or more locating attributes for narrowing a search for an
13 object of the objects; each locating attribute being from a relatively large
14 distribution of similar attributes across the objects; and

15 identifying one or more classifying attributes for filtering out objects from a
16 search for an object, each classifying attribute being from a relatively small
17 distribution of similar attributes across the objects.

1
2 **21.** A computer for representing directory-based object inter-object
3 relationships, the computer comprising:

4 a processor; and

5 a memory coupled to the processor, the memory comprising computer-
6 executable instructions and data, the processor for fetching and executing the
7 computer-executable instructions, the computer-executable instructions
8 comprising instructions for:

9 receiving data from a data store, the data corresponding to a plurality
10 of objects; and

11 responsive to receiving the data, dynamically generating multiple
12 hierarchies of inter-object relationships based on values of attributes of the objects,
13 the multiple hierarchies of inter-object relationships being a data polyarchy.

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15 **22.** A computer as recited in claim 21, wherein the data store comprises
16 a directory or a database.

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18 **23.** A computer as recited in claim 21, wherein the data polyarchy
19 comprises intersecting hierarchies of inter-object relationships.

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21 **24.** A computer as recited in claim 21, wherein the data polyarchy
22 comprises an elastic inter-object relationship.

1 **25.** A computer as recited in claim 21, wherein the computer-executable
2 instructions for dynamically generating multiple hierarchies of inter-object
3 relationships further comprise instructions for:

4 identifying a dimensional relationship of one or more dimensional
5 relationships between a first and second object of the objects; and

6 inserting the first object into the second object such that the first object is
7 represented in the second object with respect to the dimensional relationship.

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9 **26.** A computer as recited in claim 21, wherein first and second objects
10 of the objects are respectively represented in the data polyarchy as separate
11 entities, and wherein the computer-executable instructions for dynamically
12 generating multiple hierarchies of inter-object relationships further comprise
13 instructions for:

14 identifying a dimensional relationship of one or more dimensional
15 relationships between the first object and the second object; and

16 inserting a link to the first object in the second object with respect to the
17 dimensional relationship.

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19 **27.** A computer as recited in claim 26, wherein the link is a jump gate.

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21 **28.** A computer as recited in claim 21, wherein the multiple hierarchies
22 of inter-object relationships are represented independent of object naming and
23 independent of a predetermined hierarchical data structure.

1 **29.** A computer as recited in claim 21, wherein the inter-object
2 relationships represent mono-directional object relationships and bi-directional
3 object relationships.

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5 **30.** A computer as recited in claim 21, wherein is the data polyarchy
6 comprises a membership hierarchy that provides for de-referenced dimensional
7 navigation of a many-to-many object relationship.

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9 **31.** A computer as recited in claim 21, wherein the computer-executable
10 instructions for generating the data polyarchy further comprise instructions for:

11 relating a first and a second object of the objects to a third object of the
12 objects to facilitate de-referenced dimensional navigation of a many-to-many
13 object relationship between the first, second, and third objects.

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15 **32.** A computer as recited in claim 21, wherein the computer-executable
16 instructions for generating the data polyarchy further comprises instructions for
17 establishing, for individual ones of the objects, a plurality of predicates to indicate
18 how to access the individual ones of the objects.

19
20 **33.** A computer as recited in claim 21, wherein the computer-executable
21 instructions for generating the data polyarchy further comprise instructions for
22 establishing for individual ones of the objects a plurality of domain properties
23 identify to index the individual ones of the objects.

1 **34.** A computer as recited in claim 33, wherein the domain properties
2 comprise a data type, a data precision indication, a scale indication, and a
3 nullability indication.

4
5 **35.** A computer as recited in claim 21, wherein the computer-executable
6 instructions for generating the data polyarchy further comprise instructions for
7 determining the relative distribution of attributes of the objects to establish a
8 strategy to present or search for objects that comprise the attributes.

9
10 **36.** A computer as recited in claim 21, wherein the computer-executable
11 instructions for generating the data polyarchy further comprise instructions for:

12 determining the relative distribution of attributes of the objects to establish
13 a strategy to present or search for objects that comprise the attributes, and wherein
14 the strategy comprises one or more of the following operations:

15 a first operation to find a default search object of the objects;

16 a second operation to locate a particular object of the objects;

17 a third operation to obtain a default hierarchy of data relationships that
18 correspond to a particular object of the objects;

19 a fourth operation to obtain a particular hierarchy of data relationships that
20 correspond to a particular object of the objects;

21 a fifth operation to identify at least one subset of a plurality of hierarchies
22 of data relationships that correspond to a particular object of the objects; and

23 a sixth operation to obtain multiple hierarchies of data relationships that
24 correspond to a particular object of the objects.
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1 **37.** A computer as recited in claim 36, wherein the strategy comprises a
2 recursive access strategy or a linear scan access strategy.

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4 **38.** A computer as recited in claim 36, wherein the domain properties
5 comprise a logical domain property comprising a distinguishing domain, a
6 locating domain, or a classifying domain.

7
8 **39.** A computer as recited in claim 21, wherein each object further
9 comprises one or more respective attributes, and wherein the computer-executable
10 instructions for generating the data polyarchy further comprise instructions for:

11 identifying a plurality of distinguishing attributes, each distinguishing
12 attribute representing a respective object of the objects that is a root of a hierarchy,
13 each distinguishing attribute being from a substantially unique distribution of
14 similar attributes across the objects;

15 identifying one or more locating attributes for narrowing a search for an
16 object of the objects; each locating attribute being from a relatively large
17 distribution of similar attributes across the objects; and

18 identifying one or more classifying attributes for filtering out objects from a
19 search for an object, each classifying attribute being from a relatively small
20 distribution of similar attributes across the objects.

21
22 **40.** A data structure comprising:

23 a plurality of virtual object data fields, each virtual object data field
24 corresponding to a respective object of a plurality of objects in a data store, the
25

1 virtual object data fields indicating multiple hierarchies of inter-object
2 relationships based on attributes of the objects.

3
4 **41.** A data structure as recited in claim 40, wherein the data store is a
5 directory or a database.

6
7 **42.** A data structure as recited in claim 40, wherein each virtual object
8 data field further comprises:

9 a first globally unique identifier (GUID) data field to uniquely identify a
10 corresponding object in the data store.

11
12 **43.** A data structure as recited in claim 40, wherein a virtual object data
13 field corresponds to a first object of the objects, and wherein the virtual object data
14 field further comprises an entity reference data field to uniquely identify a second
15 object of the objects as a sub-element of the first object, the entity reference data
16 field uniquely identifying the second object in the data store.

17
18 **44.** A data structure as recited in claim 43, wherein the entity reference
19 is a GUID.

20
21 **45.** A data structure as recited in claim 40, wherein each virtual data
22 object data field further comprises one or more predicate data fields, each
23 predicate data field indicating a respective operation to present a particular object
24 with respect to one or more hierarchies of inter-object relationships.
25

1 **46.** A data structure as recited in claim 40, wherein each virtual data
2 object data field further comprises:

3 a domain property data field to index a corresponding object of the objects
4 with respect to one or more hierarchies of inter-object relationships.

5
6 **47.** A data structure as recited in claim 46, wherein the domain property
7 data field further comprises:

8 a physical domain comprising a data type, a data precision indication, a
9 scale indication, or a nullability indication; and

10 a logical domain comprising a unique domain, a locating domain, or a
11 classifying domain.

12
13 **48.** A computer-readable medium having stored thereon a data structure
14 as recited in claim 40.

15
16 **49.** A computer-readable medium comprising computer-executable
17 instructions for:

18 receiving data from a data store, the data corresponding to a plurality of
19 objects; and

20 responsive to receiving the data, dynamically generating multiple
21 hierarchies of inter-object relationships based on values of attributes of the objects,
22 the multiple hierarchies of inter-object relationships being a data polyarchy.

1 **50.** A computer-readable medium as recited in claim 49, wherein the
2 data store comprises a directory or a database.

3
4 **51.** A computer-readable medium as recited in claim 49, wherein the
5 data polyarchy comprises intersecting hierarchies of inter-object relationships.

6
7 **52.** A computer-readable medium as recited in claim 49, wherein the
8 data polyarchy comprises an elastic inter-object relationship.

9
10 **53.** A computer-readable medium as recited in claim 49, wherein the
11 data polyarchy comprises a complex object that is related to one or more sub-
12 objects in the data polyarchy, and wherein the computer-executable instructions
13 for determining inter-object relationships further comprise instructions for:

14 representing the complex object as an independent surface entity; and

15 referencing the one or more sub-objects in the independent surface entity as
16 separate entities, the one or more sub-objects being referenced independent of
17 object naming and independent of a hierarchical data relationship between the
18 surface entity and the one or more sub-objects.

19
20 **54.** A computer-readable medium as recited in claim 49, wherein the
21 data polyarchy comprises a first object that is related to one or more sub-objects in
22 the data polyarchy, and wherein the computer-executable instructions for
23 determining the inter-object relationships further comprise instructions for:

24 representing the first object as a surface entity;

1 representing each of the one or more sub-objects as respective separate
2 entities that are independent of the surface entity; and

3 referencing the surface object in each of the one or more sub-objects
4 independent of any object naming or hierarchical relationship.
5

6 **55.** A computer-readable medium as recited in claim 49, wherein the
7 multiple hierarchies of inter-object relationships are represented independent of
8 object naming and independent of a predetermined hierarchical data structure.
9

10 **56.** A computer-readable medium as recited in claim 49, wherein the
11 inter-object relationships represent mono-directional object relationships and bi-
12 directional object relationships.
13

14 **57.** A computer-readable medium as recited in claim 49, wherein is the
15 data polyarchy comprises a membership hierarchy that provides for de-referenced
16 dimensional navigation of a many-to-many object relationship.
17

18 **58.** A computer-readable medium as recited in claim 49, wherein the
19 computer-executable instructions for generating the data polyarchy further
20 comprise instructions for:

21 relating a first and a second object of the objects to a third object of the
22 objects to facilitate de-referenced dimensional navigation of a many-to-many
23 object relationship between the first, second, and third objects.
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1 **59.** A computer-readable medium as recited in claim 49, wherein the
2 computer-executable instructions for generating the data polyarchy further
3 comprises instructions for establishing, for individual ones of the objects, a
4 plurality of predicates to indicate how to access the individual ones of the objects.

5
6 **60.** A computer-readable medium as recited in claim 49, wherein the
7 computer-executable instructions for generating the data polyarchy further
8 comprise instructions for determining the relative distribution of attributes of the
9 objects to establish a strategy to present or search for objects that comprise the
10 attributes.

11
12 **61.** A computer-readable medium as recited in claim 49, wherein each
13 object further comprises one or more respective attributes, and wherein the
14 computer-executable instructions for generating the data polyarchy further
15 comprise instructions for:

16 identifying a plurality of distinguishing attributes, each distinguishing
17 attribute representing a respective object of the objects that is a root of a hierarchy,
18 each distinguishing attribute being from a substantially unique distribution of
19 similar attributes across the objects;

20 identifying one or more locating attributes for narrowing a search for an
21 object of the objects; each locating attribute being from a relatively large
22 distribution of similar attributes across the objects; and

23 identifying one or more classifying attributes for filtering out objects from a
24 search for an object, each classifying attribute being from a relatively small
25 distribution of similar attributes across the objects.

1 **62.** A computer-readable medium as recited in claim 49, wherein the
2 computer-executable instructions for generating the data polyarchy further
3 comprise instructions for establishing for individual ones of the objects a plurality
4 of domain properties identify to index the individual ones of the objects.

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6 **63.** A computer-readable medium as recited in claim 62, wherein the
7 domain properties comprise a data type, a data precision indication, a scale
8 indication, and a nullability indication.

9
10 **64.** A computer-readable medium as recited in claim 49, wherein the
11 computer-executable instructions for generating the data polyarchy further
12 comprise instructions for:

13 determining the relative distribution of attributes of the objects to establish
14 a strategy to present or search for objects that comprise the attributes, and wherein
15 the strategy comprises one or more of the following operations:

16 a first operation to find a default search object of the objects;

17 a second operation to locate a particular object of the objects;

18 a third operation to obtain a default hierarchy of data relationships that
19 correspond to a particular object of the objects;

20 a fourth operation to obtain a particular hierarchy of data relationships that
21 correspond to a particular object of the objects;

22 a fifth operation to identify at least one subset of a plurality of hierarchies
23 of data relationships that correspond to a particular object of the objects; and

24 a sixth operation to obtain multiple hierarchies of data relationships that
25 correspond to a particular object of the objects.

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2 **65.** A computer-readable medium as recited in claim 64, wherein the
3 strategy comprises a recursive access strategy or a linear scan access strategy.
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5 **66.** A computer-readable medium as recited in claim 64, wherein the
6 domain properties comprise a logical domain property comprising a distinguishing
7 domain, a locating domain, or a classifying domain.
8

9 **67.** A computer for representing directory-based object inter-object
10 relationships, the computer comprising processing means for:

11 receiving data from a data store, the data corresponding to a plurality
12 of objects; and

13 responsive to receiving the data, dynamically generating multiple
14 hierarchies of inter-object relationships based on values of attributes of the objects,
15 the multiple hierarchies of inter-object relationships being a data polyarchy.
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17 **68.** A computer as recited in claim 67, wherein the data polyarchy
18 comprises intersecting hierarchies of inter-object relationships.
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20 **69.** A computer as recited in claim 67, wherein the data polyarchy
21 comprises an elastic inter-object relationship.
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1 **70.** A computer as recited in claim 67, wherein the means for
2 dynamically generating multiple hierarchies of inter-object relationships further
3 comprise means for:

4 identifying a dimensional relationship of one or more dimensional
5 relationships between a first and second object of the objects; and

6 inserting the first object into the second object such that the first object is
7 represented in the second object with respect to the dimensional relationship.

8
9 **71.** A computer as recited in claim 67, wherein first and second objects
10 of the objects are respectively represented in the data polyarchy as separate
11 entities, and wherein the means for dynamically generating multiple hierarchies of
12 inter-object relationships further comprise means for:

13 identifying a dimensional relationship of one or more dimensional
14 relationships between the first object and the second object; and

15 inserting a link to the first object in the second object with respect to the
16 dimensional relationship.

17
18 **72.** A computer as recited in claim 68, wherein the link is a jump gate.

19
20 **73.** A computer as recited in claim 67, wherein the multiple hierarchies
21 of inter-object relationships are represented independent of object naming and
22 independent of a predetermined hierarchical data structure.

1 74. A computer as recited in claim 67, wherein is the data polyarchy
2 comprises a membership hierarchy that provides for de-referenced dimensional
3 navigation of a many-to-many object relationship.

4
5 75. A computer as recited in claim 67, wherein the means for generating
6 the data polyarchy further comprise means for:

7 relating a first and a second object of the objects to a third object of the
8 objects to facilitate de-referenced dimensional navigation of a many-to-many
9 object relationship between the first, second, and third objects.

10
11 76. A computer as recited in claim 67, wherein the means for generating
12 the data polyarchy further comprises means for establishing, for individual ones of
13 the objects, a plurality of predicates to indicate how to access the individual ones
14 of the objects.

15
16 77. A computer as recited in claim 67, wherein the means for generating
17 the data polyarchy further comprise means for establishing for individual ones of
18 the objects a plurality of domain properties identify to index the individual ones
19 of the objects.

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21 78. A computer as recited in claim 77, wherein the domain properties
22 comprise a data type, a data precision indication, a scale indication, and a
23 nullability indication. .
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1 **79.** A computer as recited in claim 67, wherein the means for generating
2 the data polyarchy further comprise means for determining the relative distribution
3 of attributes of the objects to establish a strategy to present or search for objects
4 that comprise the attributes.

5
6 **80.** A computer as recited in claim 67, wherein the means for generating
7 the data polyarchy further comprise means for:

8 determining the relative distribution of values assumed by attributes of the
9 objects to establish a strategy to present or search for objects that comprise the
10 attributes, and wherein the strategy comprises one or more of the following
11 operations:

12 a first operation to find a default search object of the objects;

13 a second operation to locate a particular object of the objects;

14 a third operation to obtain a default hierarchy of data relationships that
15 correspond to a particular object of the objects;

16 a fourth operation to obtain a particular hierarchy of data relationships that
17 correspond to a particular object of the objects;

18 a fifth operation to identify at least one subset of a plurality of hierarchies
19 of data relationships that correspond to a particular object of the objects; and

20 a sixth operation to obtain multiple hierarchies of data relationships that
21 correspond to a particular object of the objects.

22
23 **81.** A computer as recited in claim 80, wherein the strategy comprises a
24 recursive access strategy or a linear scan access strategy.
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1 82. A computer as recited in claim 80, wherein the domain properties
2 comprise a logical domain property comprising a distinguishing domain, a
3 locating domain, or a classifying domain.

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5 83. A computer as recited in claim 67, wherein each object further
6 comprises one or more respective attributes, and wherein the means for generating
7 the data polyarchy further comprise means for:

8 identifying a plurality of distinguishing attributes, each distinguishing
9 attribute representing a respective object of the objects that is a root of a hierarchy,
10 each distinguishing attribute being from a substantially unique distribution of
11 similar attributes across the objects;

12 identifying one or more locating attributes for narrowing a search for an
13 object of the objects; each locating attribute being from a relatively large
14 distribution of similar attributes across the objects; and

15 identifying one or more classifying attributes for filtering out objects from a
16 search for an object, each classifying attribute being from a relatively small
17 distribution of similar attributes across the objects.